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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/380,864	12/02/1999	MARTYN VINCENT TWIGG	JMYT-V00200	3166

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EXAMINER	
LEUNG, JENNIFER A	
ART UNIT	**PAPER NUMBER**
1764	

DATE MAILED: 06/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/380,864	TWIGG, MARTYN VINCENT	
	Examiner	Art Unit	
	Jennifer A. Leung	1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *9-12,14-16,18,21-30,32,34 and 35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *9-12,14-16,18,21-30,32,34 and 35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment submitted on March 11, 2005 has been received and carefully considered. Claims 1-8, 13, 17, 19, 20, 31 and 33 are cancelled. Claims 9-12, 14-16, 18, 21-30, 32, 34 and 35 remain active.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 9-12, 14-16, 18, 21-30, 32, 34 and 35 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Regarding claims 9, 21 and 34, it is unclear as to where the limitation, "wherein the volume of the lean NOx catalyst system is 300% or greater than that of the volume of the oxidation catalyst system," (claim 9, lines 14-15; claim 21, lines 12-13; claim 34, lines 15-16), finds support in Applicant's specification. It is noted that the specification only shows support for a lean-NOx catalyst having a *length* that is three times, or 300%, the *length* of the oxidation catalyst (Example 1, page 6, line 16 to page 7, line 26; see Note (5), wherein the lean-NOx catalyst is 9 in. long and the oxidation catalyst is 3 in. long). There is no indication that the respective diameters of the lean-NOx catalyst and the oxidation catalyst are equal, and therefore,

a *volume* ratio of 300% cannot be assumed. Applicant further attempts to show that "increasing *catalyst length* and hence decreasing space velocity is beneficial in overall NOx conversion." (Test 2, page 5, line 14 to page 6, line 15). Again, no catalyst diameters are specified. It is further noted that Test 2 not only varies the length of each catalyst *but also* varies the loading per unit volume of each catalyst. In particular, "The increase in NOx conversion, at a constant platinum loading (1.5g) *per catalyst brick*, by decreasing space velocity *and reducing loading in g/unit volume* was measured." (page 5, lines 16-18). As mentioned in Test 1 (page 5, line 12), a reduced loading per unit volume of catalyst improves NOx selectivity. Thus, Test 2 does not sufficiently evidence that the increase in NOx conversion was due solely to increasing catalyst length, since the catalyst loading per unit volume was varied simultaneously, and it was set forth in Test 1 that varying the catalyst loading per unit volume affects NOx conversion.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 9-16, 21-30, 34 and 35 are rejected under 35 U.S.C. 103(a) as obvious over Tsuchitani et al. (EP 0 666 099) in view of Yokota et al. (JP 08-114116).

Regarding claims 9, 14, 21, 26, 34 and 35, Tsuchitani et al. discloses a combination of a lean burn engine (i.e., a gasoline or diesel engine, a boiler, etc. that generates exhaust gas under an oxidizing or air-rich atmosphere; page 3, lines 1-33; page 4, lines 1, 2 and 27-35; page 5, lines 23-26) and an emission control system, said emission control system comprising:

a) a lean NO_x catalyst system comprising a platinum group metal (PGM) for reducing NO_x to N_2, wherein the PGM consists of platinum (page 7, lines 47-55);

b) an oxidation catalyst system comprising a PGM, such as platinum, for oxidizing hydrocarbons and carbon monoxide, disposed downstream from the lean NO_x catalyst system (page 9, lines 38-44); and

c) means for injecting hydrocarbon fuel into the exhaust upstream of the lean NO_x catalyst system (page 5, lines 27-49; see also FIG. 1, wherein the hydrocarbon fuel "C_3H_6" is injected upstream of the lean NOx catalyst **4**);

wherein the platinum metal is present in the lean NO_x catalyst system at a loading of less than 30 g/ft^3 (i.e., generally, 0.1 to 30 grams Pt per liter of catalyst, or preferably, 0.5 to 5 grams Pt per liter of catalyst; page 7, line 56 to page 8, line 9).

Additionally, Tsuchitani et al. (page 4, line 6 to page 5, line 14; see claims) discloses a process for controlling the emissions from said lean burn engine, above, said process comprising:

a) passing exhaust gases from the engine over said lean NO_x catalyst system;

b) passing the product gases exiting from the lean NO_x catalyst system over said oxidation catalyst system; and

c) introducing additional hydrocarbon fuel into the exhaust gas upstream of said lean NO_x catalyst system.

Tsuchitani et al. (page 7, lines 37-46) suggests that the reactivity as manifested by a given catalyst directly relates the space velocity of the exhaust gas relative to the catalyst bed, and hence, the reactivity as manifested by the catalyst is also a function of the catalyst volume. In particular, Tsuchitani et al. discloses,

> "... the space velocity (S.V.) of the exhaust gas under treatment relative to the catalyst bed is preferable to be in the range of 1,000 to 300,000/hr, preferably 10,000 to 200,000/hr. *If the space velocity exceeds 300,000/hr, the catalyst will manifest ample reactivity with difficulty. Conversely, if it falls short of 1,000/hr, the catalyst will have to be increased in volume*, and moreover, the diffusion in the flow path of gas will bring about the influence of nullifying the effect of intermittently introducing the reducing substance or imparting a reducing atmosphere to the exhaust gas."

Tsuchitani et al., however, is silent as to the volume of the lean NO_x catalyst system being, specifically, 300 % or greater than that of the volume of the oxidation catalyst system.

Yokota et al. (FIG. 1; Abstract; Machine Translation) teaches an emission control system comprising a lean NOx catalyst system (i.e., low-oxidation active zone **11**; sections [0016]-[0018]) located upstream of an oxidation catalyst system (i.e., high-oxidation active zone **12**; sections [0019]). In particular, Yokota et al. teaches that the volume of the lean NOx catalyst system **11** is much larger than the volume of the oxidation catalyst system **12**, wherein the volume of the lean NOx catalyst system **11** may be 20 times, or 10 times, the volume of the oxidation catalyst system **12** (see section [0021], [0022]). As an example, Yokota et al. also teaches the lean NOx catalyst **11** may have a length of about 10 cm to 30 cm, or 5 cm to 50 cm, as compared to the oxidation catalyst **12** having a length of about 0.5 cm to 10 cm, for a standard sized car (see section [0024]).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to select an appropriate volume for the lean NO_x catalyst system relative to the oxidation catalyst system (i.e., such as the claimed ratio of at least 3:1, lean NOx catalyst-to-oxidation catalyst) in the process and apparatus of Tsuchitani et al., on the basis of suitability for the intended use and absent showing any unexpected results thereof, because configuring the lean NOx catalyst system to be significantly larger than the oxidation catalyst system improves

the purification performance of the emission control system, as taught by Yokota et al. Additionally, it has been held that where the general conditions of a claim are disclosed in the prior art, discovering optimum or workable ranges involves routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding claims 10, 11, 22 and 23, Tsuchitani et al. is silent as to whether the NO_x catalyst has an activity sufficient to provide a ratio of % NO_x to % HC conversion of at least 0.2, or whether the oxidation catalyst has an activity sufficient to provide a % HC conversion greater than 80% and a % CO conversion greater than 70%, as measured under the testing conditions of 230 °C, a space velocity of 25,000 hr^{-1} and a HC:NO_x input ratio of 3:1 counting the HC as equivalent propane. In any event, the modified system and method of Tsuchitani et al. meet the claims, since although the instantly claimed conversion rates for the given testing conditions are not specifically disclosed, a newly discovered property does not necessarily mean the product is unobvious, since this property may be inherent in the prior art. *In re Best 195 USPQ 430 (CCPA 1977); In re Swinehart 169 USPQ 226 (CCPA 1971).* The modified system and process of Tsuchitani et al. substantially comprises each of the elements of the instantly claimed invention and therefore one of ordinary skill in the art would not expect a different and/or unexpected result to be obtained. Furthermore, it would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to select an appropriate temperature, space velocity and input ratio for the catalyst system evaluation on the basis of suitability for the intended use, since what is recited is merely a testing condition, and where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art, *In re Aller, 105 USPQ 233.*

Regarding claims 12, 13 and 24, Tsuchitani et al. discloses the lean NOx catalyst system may further comprise an alkaline earth metal (i.e., beryllium, magnesium, calcium, strontium barium, or a compound of the metal; page 7, lines 47-55).

Regarding claims 15 and 27, Tsuchitani et al. discloses the oxidation catalyst system PGM loading is about 100 g/ft^3 (i.e., "... the noble metal to be preferable is desired to be in the range of 0.1 to 5 g per liter of the catalyst," page 9, line 55 to page 10, line 19).

Regarding claims 16 and 28, Tsuchitani et al. discloses the oxidation or lean NO_x catalyst system further comprise alumina, ceria or zirconia (page 8, line 33 to page 9, line 1).

Regarding claim 25, Tsuchitani et al. discloses the oxidation catalyst system further comprises a base metal (i.e., iron, nickel; page 9, line 55 to page 10, line 19).

Regarding claim 29 and 30, Tsuchitani et al. (page 7, lines 37-46) discloses,

> "... the space velocity (S.V.) of the exhaust gas under treatment relative to the catalyst bed is preferable to be in the range of 1,000 to 300,000/hr, preferably 10,000 to 200,000/hr. If the space velocity exceeds 300,000/hr, the catalyst will manifest ample reactivity with difficulty. Conversely, if it falls short of 1,000/hr, the catalyst will have to be increased in volume, and moreover, the diffusion in the flow path of gas will bring about the influence of nullifying the effect of intermittently introducing the reducing substance or imparting a reducing atmosphere to the exhaust gas."

Accordingly, it would have been obvious for one of ordinary skill in the art at the time the invention was made to select the claimed space velocities in the method of Tsuchitani et al., because the specific space velocities would have been considered a result effective variable, and one having ordinary skill in the art would have routinely optimized the space velocity for each of the lean NO_x catalyst system and oxidation catalyst system on the basis of the desired catalytic reactivity. *In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980). Furthermore, it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the

optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

4. Claims 18 and 32 are rejected under 35 U.S.C. 103(a) as obvious over Tsuchitani et al. (EP 0 666 099) in view of Yokota et al. (JP 08-114116), as applied to claims 9 and 21 above, and further in view of Kihara et al. (JP 05-288044).

Tsuchitani et al. is silent as to providing the lean NOx catalyst system as two catalytic substrates arranged in parallel. Kihara et al. (FIG. 1; Abstract; Machine Translation) teaches an emission control system comprising a lean NO_x catalyst coated on two substrates **6** and **8** arranged in parallel. It would have been obvious for one of ordinary skill in the art at the time the invention was made to configure the lean NO_x catalyst on two substrates arranged in parallel in the modified system and process of Tsuchitani et al. because the space velocity through the catalysts can be made small even in the case of a high load, thereby improving the rate of NOx purification, as taught by Kihara et al. (see also section [0018]).

Response to Arguments

5. Applicant's arguments filed on March 11, 2005 have been fully considered but they are not persuasive. Beginning on page 10, in middle of the page, Applicants argue,

> "The applicant's process claims... specifically require the step of passing the exhaust gases from the engine over a lean NO_x catalyst *system to reduce NO_x to N_2* (Emphasis Added). The applicant has not found a disclosure or suggestion in Tsuchitani et al. that reduces NO_x in exhaust gasses to N_2. As cited in the above passage, Tsuchitani et al. describes the absorber/catalyst as an oxidation catalyst (see paragraph [0018]). Tsuchitani et al. is concerned with oxidizing N_2O or NO to NO_x at the absorber/oxidation catalyst. "Reducing" is mentioned in reference to regenerating the NO_x absorber/oxidation catalyst as described by paragraph [0033] and not in reference to reducing NO_x in the exhaust gases to N_2."

The Examiner respectfully disagrees. Firstly, it is unclear as to what paragraphs Applicant is referring to (e.g., paragraphs [0018] and [0033]) because the Tsuchitani et al. reference does not

use such paragraph notations but employs pages and line numbers. Secondly, Tsuchitani et al. discloses on several occasions that the function of the catalyst is ultimately to reduce or decompose the NOx.

On page 5, lines 23-30, Tsuchitani et al. discloses (with emphasis added),

> "... an exhaust gas containing NO_x is brought into contact with a component manifesting an oxidizing activity in an oxidizing atmosphere so that NO, N_2O, etc. which are generally present at high proportions in the NO_x components of the exhaust gas are oxidized or activated into NO_2. The NO_2 thus resulting from the oxidation or activation is then adsorbed on a component possessing an NO_2 adsorbing ability. *By introducing a reducing substance instantaneously into the exhaust gas enveloping the NO_x accumulated on the adsorbent component,* ***the adsorbed NO_x is reduced or decomposed to complete the removal of NO_x. It is the catalyst contemplated by this invention that discharges the function of reducing or decomposing the NO_x.***"

On page 7, lines 10-20, Tsuchitani et al. discloses (with emphasis added),

> "... *the NO_x adsorbed on the catalyst* in consequence of oxidation or activation is concentrated in an activated state on the catalyst as compared with the conventional method and, therefore, ***can be reduced by the catalyst with high selectivity*** unlike the method which comprises continuous introduction of the reducing agent."

On page 7, line 56 to page 8, line 9, Tsuchitani et al. discloses (with emphasis added),

> "In the components mentioned above, such noble metals as platinum, palladium, rhodium, and ruthenium, particularly platinum and/or palladium, are effective in oxidizing NO_x in an oxidizing atmosphere. ***These noble metals function to reduce and decompose NO_x in the presence of a reducing substance or in a reducing atmosphere*** *besides function to oxide NO_x in an oxidizing atmosphere.* By using these noble metals, therefore, the oxidation or activation of NO_x in an oxidizing atmosphere and the removal of the adsorbed NO_x, particularly NO_2, due to the intermittent introducing of a reducing substance or in a reducing atmosphere can be carried out with high efficiency."

Although the catalyst may exhibit *an intermediate step* of oxidizing or activating NO_x, in order to adsorb the NOx on the surface of the catalyst, *the catalyst ultimately functions to reduce and decompose the NO_x* in the presence of a reducing agent, and therefore, the catalyst system of

Tsuchitani et al. meets the claim of a lean NO_x catalyst system for reducing NO_x to N_2. Furthermore, Applicant appears to argue that unlike the catalyst as disclosed by Tsuchitani et al., Applicant's own lean NO_x catalyst system will not exhibit such oxidizing or activating activity in a lean atmosphere. This is not persuasive since the catalyst system as disclosed by Tsuchitani et al. and the lean NO_x catalyst as disclosed by Applicant possess the same catalytic elements (i.e., platinum metal at a loading of less than 30 g/ft^3), and it would therefore follow that the two catalysts would inherently exhibit similar properties under similar conditions. The specific mechanism in which the reduction of NO_x to N_2 occurs on such catalysts is further elaborated by Kihara et al. (see FIG. 8 and sections [0033] to [0036]).

Regarding the combination of Tsuchitani et al. with Shiraishi et al. under 35 U.S.C. 103(a), Applicant's arguments have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground of rejection is made in view of the newly found prior art reference(s), applied above.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Takeshima et al. (US 5,233,830 and US 5,365,734) are further provided to illustrate the state of the art.

* * *

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer A. Leung whose telephone number is (571) 272-1449. The examiner can normally be reached on 8:30 am - 5:30 pm M-F, every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Glenn A. Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer A. Leung
June 9, 2005

HIEN TRAN
PRIMARY EXAMINER